

TWO IN PLUS TWO OUT EQUALS MORE THAN FOUR

STRATEGIC MANAGEMENT OF CHANGE

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ABSTRACT

Fort Scott Fire Department has not determined staffing requirements needed at the scene of a free-burning structure fire before an interior attack is initiated. The purpose of this applied research paper was to describe existing standards and policies and identify potential changes that should be made regarding staffing requirements at the scene of a free-burning structure fire before an interior attack is initiated. The descriptive research method was utilized to answer the following questions:

1. Is there a need to determine staffing requirements at the scene of a free-burning structure fire before an interior attack is initiated?
2. What are the federal and state regulations and national standards regarding staffing requirements at the scene of a free-burning structure fire before an interior attack is initiated?
3. What do paid or combination fire departments in Kansas perceive to be appropriate staffing requirements at the scene of a free-burning structure fire before an interior attack is initiated?
4. What factors are appropriate for consideration in the development of Fort Scott Fire Department's policy regarding staffing requirements at the scene of a free-burning structure fire before an interior attack is initiated?

Procedures for the project included an extensive literature review and a survey of 51 Kansas fire departments to describe fire service opinions, federal and state regulations, national standards, and Kansas fire departments' policies regarding staffing requirements at the scene of interior structural firefighting operations.

Results of the study revealed that there is a need to determine and implement staffing requirements at structure fires for the safety of the firefighters. Federal legislation, state regulations, and national standards all address the issue of adequate staffing for interior structural

firefighting operations from a safety standpoint. The survey results showed that paid or combination fire departments in the state of Kansas are split between requiring four persons or five or more persons on the scene of a structure fire before initiating an interior attack.

Recommendations from this research project were to develop and implement a policy regarding staffing requirements that complies with the OSHA two in, two out rule at structure fires, maintain a staffing level of five firefighters to respond to structure fires, and explore cost-effective options to maintain the five-person staffing.

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INTRODUCTION

Fort Scott Fire Department has not determined staffing requirements needed at the scene of a free-burning structure fire before an interior attack is initiated. The purpose of this applied research paper is to describe existing standards and policies and identify potential changes that should be made regarding staffing requirements at the scene of a free-burning structure fire before an interior attack is initiated. The descriptive research method was utilized to answer the following questions:

1. Is there a need to determine staffing requirements at the scene of a free-burning structure fire before an interior attack is initiated?
2. What are the federal and state regulations and national standards regarding staffing requirements at the scene of a free-burning structure fire before an interior attack is initiated?
3. What do paid or combination fire departments in Kansas perceive to be appropriate staffing requirements at the scene of a free-burning structure fire before an interior attack is initiated?
4. What factors are appropriate for consideration in the development of Fort Scott Fire Department's policy regarding staffing requirements at the scene of a free-burning structure fire before an interior attack is initiated?

BACKGROUND AND SIGNIFICANCE

Fort Scott Fire Department has one fire station serving a population of approximately 8,500. Up until 1991, the fire department was staffed with one fire chief and 15 shift personnel divided into three shifts with a minimum of five personnel on duty at all times. In 1991, the department staffing was cut to 12 shift personnel divided into three shifts with a minimum of four personnel on duty at all times.

Currently, the department responds to structure fires with all four on-duty personnel in one fire apparatus. At the scene of a free-burning structure fire, the captain is the incident commander, the driver is the pump operator, and the lieutenant and fire fighter enter the structure to make an interior attack on the fire. Off-duty personnel and reserve personnel are called in via pagers to the fire station to respond with additional apparatus as deemed necessary by the incident commander.

On January 8, 1998, Occupational Safety and Health Administration (OSHA) finalized the standard on respiratory protection, and it became effective April 8, 1998 (Respiratory Protection; Final Rule, 1998). Part of the standard includes procedures for interior structural firefighting that require at least two employees enter the immediately dangerous to life or health (IDLH) atmosphere inside the structure, and at least two employees are located outside the structure for rescue or assistance (Respiratory Protection, 1998). This has become known in the fire service as the OSHA two-in, two out rule.

“OSHA standards do not apply to state and local governments, except in states that have voluntarily elected to adopt an OSHA State Plan” (Respiratory Protection; Final Rule, 1998, p. 1155). Kansas is not one of the 25 states and territories that must adopt a comparable standard within six months of the final publication date of a final standard. However, according to Seymour (1998), the former acting director of the OSHA safety standards program, the scope of coverage of this standard applies to any department or unit of the emergency response community that uses respirators of any type in its mission. This will be the national standard protecting people who wear respiratory protection in their work. The standard establishes a new benchmark for respiratory protection. Seymour also states, “Every organization that uses

respirators will be measured by this new rule whether it wants to be or not” (Seymour, 1998, p. 7).

In addition, the Kansas Department of Human Resources (KDHR) can and will use OSHA standards when investigating work-related deaths or injuries in the state of Kansas, including municipal fire departments. Therefore, the two in, two out rule may be applied to Fort Scott Fire Department in the event of a death or injury to an employee during interior structural firefighting activities. This new respiratory protection standard will have a significant impact on Fort Scott Fire Department’s emergency response procedures and staffing requirements. If the fire department is not adequately staffed to comply with the new standard, the safety and health of our employees may be in jeopardy, and the City of Fort Scott could be liable for not complying with national safety standards.

This applied research project relates to the analysis phase of the four-phase change management model taught in the Strategic Management of Change course at the National Fire Academy by using a systematic, well-planned approach in analyzing and evaluating needed operational changes in our fire department.

LITERATURE REVIEW

General

In Lexington, Kentucky one firefighter died and another was seriously injured while performing interior structural firefighting activities in February, 1997 (“Feds and State,” 1997). Both the National Institute of Occupational Safety and Health (NIOSH) and the state OSHA investigations concluded that there was a failure to follow the two in, two out rule. The firefighters were trapped in the basement of the structure for at least eight minutes before others

realized they were missing. Lexington Fire Chief William Holleran stated to the Lexington-Fayette Urban County Council, ““We have every intention of fulfilling the intent of these recommendations. When you have an incident like this it’s a very tragic thing. We want to try to avoid it at all costs”” (“Feds and State,” 1997, p. 6).

In 1996, John Hudgins and Frank E. Young were killed while fighting a fire in an auto parts store before the second engine company arrived at the scene. Mrs. Hudgins said that her husband’s death was not in vain and she hopes and prays that, thanks to the new rule, no other firefighters will lose their lives because there was no one standing by to help them (“Major Victory,” 1998).

Bruno (1998) says that the two in, two out rule is another step in protecting firefighters as they perform an inherently dangerous job. He also states that this new rule, along with NFPA 1500, can be used as evidence that two and three person companies are not as safe and effective as four and five person companies.

Cobb (1998) discusses recent reports that indicate firefighters are being killed and seriously injured during the initial stages of the fire. Factors that contribute to early injuries and deaths include lightweight-wood-truss construction, energy-efficient windows, older buildings, and lack of survival training. In describing the need for a standby rescue team, Cobb (1998, p. 54) summarizes, “In several case studies, once the incident commanders became aware of missing members, there were no resources immediately available to rescue them. If all initial resources are committed to what looks like a ‘textbook’ job, what happens when Murphy’s Law comes into play?”

Representing the Fire Department Safety Officers Association, Soros (1997) explained that the two in, two out rule can be enforced because the fire service itself has shown that

sufficient manpower is a key to reducing injuries. In addition, the fact that inadequate manpower can cause death or injuries can be established in court, and there are feasible methods that can correct the inadequate manpower situation. Soros goes on to state, “Safety is a word in the fire service and a concept in industry” (Soros, 1997, p. 8).

Marantette explains that the two in, two out issue is not totally focused on firefighter safety. He states, “What we have is an economic issue, and the debate over the right balance between the cost of fire protection, firefighter safety and the potential loss of property will continue regardless of the OSHA rule” (Marantette, 1998, p. 36).

The two in, two out issue is not a new one. Before becoming a regulation it was part of Assistant Secretary of Labor James Stanley’s interpretation of safety regulations issued in 1995 (Campbell, 1998). Additionally, NFPA 1500 addressed the issue of staffing by recommending a minimum staffing level of four personnel with each engine and ladder company in 1987 in the appendix of the first edition of NFPA 1500 (Varone, 1994).

Coleman and Granito (1988) discussed controlled and statistically based experiment conclusions that said if about sixteen trained firefighters were not on the scene of a working fire within the critical time period, dollar loss and injuries were significantly increased, as well as the fire spread. Coleman and Granito (1988, p. 119) stated,

As firefighting tactics were conducted for comparative purposes, five-person fire suppression companies were judged to be 100 percent effective in their task performance, four-person companies 65 percent effective, and three-person companies 38 percent effective; six-person companies are judged 20 percent faster than four-person companies.

Norman (1997a) discusses the reasoning behind the need to take definite steps, including providing rapid intervention teams, toward reducing firefighter injury and mortality rates. Even

though firefighter deaths have dropped from around 140 deaths per year to around 100 deaths per year, there is a disturbing trend found in the remaining deaths, firefighters are dying from exposure to fire and products of combustion. Citing a survey conducted by Dunn, Norman (1997a, p. 18) states, "...out of 173 firefighters who died on the fireground during one recent 10-year period, 113 were caught or trapped and subsequently died from products of combustion." Norman (1997b) emphasizes the need for a rapid intervention team of more than two persons. Norman says that a two-person team will find great difficulty in removing an unconscious firefighter from anywhere in the structure except the first floor or another place that a simple drag can be utilized. Norman (1997b, p.75) further clarifies the number of firefighters needed to rescue another firefighter by stating, "You must arrange for a team (I believe four people is the absolute minimum to carry out a successful rescue of a downed firefighter, in simple circumstances) to be immediately available at every working fire or special operation."

Routley, Bush, and Stern (1996) wrote that the most challenging problem concerning firefighter deaths is how to reduce fireground deaths caused by the inherent risks we normally associate with firefighting, such as being caught or trapped inside burning buildings, not having enough air, falling through floors or roofs, and having things fall on us.

Dziuban (1998) conducted a survey of 118 fire departments and compiled data from 84 returns. One of the questions asked the respondents to state the minimum number of firefighters required on the fireground prior to starting interior structural firefighting when the OSHA exception to the two in, two out rule does not apply. His findings showed that a plurality of the respondents, 40 fire departments (47.6%), required five or more firefighters on the scene prior to initiating an interior attack. Only 32 fire departments (38.1%) required four, and 11 (13.1%) required less than four. One respondent (1.2%) did not answer that question.

Dzubian influenced this project because his findings showed an even greater percentage of surveyed fire departments require five or more persons on scene, before conducting an interior fire attack, than the author's survey. However, both surveys indicated that fire departments are realizing that more than four firefighters are necessary to operate safely and meet the intent of the two in, two out rule.

Federal and State Regulations

For interior structural fire-fighting procedures, federal regulations require, "At least two employees enter the IDLH atmosphere and remain in visual or voice contact with one another at all times; At least two employees are located outside the IDLH atmosphere; ..." (Respiratory Protection, 1998, p. 419). Although OSHA does not specify the number of personnel required in addition to the two personnel inside and two personnel outside, it does imply that more than four personnel are required by stating, "Most fire departments have more than four firefighters and can assemble the numbers required on the scene by waiting for others to arrive" (OSHA, 1998, p. 37).

The inside personnel are to remain in visual or voice contact with one another. The employees outside the IDLH atmosphere must be trained and equipped to provide emergency rescue.

The regulation also states that one of the two outside employees may be assigned another role, such as incident commander or safety officer. This employee must be able to provide assistance without jeopardizing the safety or health of any firefighter at the incident. The regulation does not state the specific duties of the other outside employee. However, OSHA (1998) interprets by stating, "One of the outside firefighters must actively monitor the status of the inside firefighters and may not be assigned additional duties" (p. 36). OSHA further clarifies

that the second outside firefighter may be involved in a variety of activities, however, both outside personnel must be available to assist and support the two inside firefighters. Any assignment of duties should be measured against the potential interference of the requirement to assist and support.

Some examples of other functions, suggested by OSHA, that might be performed by one of the outside persons include pump operations, incident command, feed and direct hose, hydrant operations, and outside hose line operations (OSHA, 1998).

OSHA does not specifically clarify the distance allowed from the outside person to the entry point to the structure, but does suggest that it should be considered in making the assignment to the rescue team.

In a response letter to J. Curtis Varone, OSHA Directorate of Compliance Programs Miles (1998) questions Varone's premise that one of the outside members would need to serve as a full-time incident commander. Miles (1998) states, "We believe it should be possible for one crew member to operate the pump or perform any other necessary support activities, while the other monitors the inside team" (p. 2).

In the same letter, Miles gives two examples of firefighter fatalities. In the first one, a Lexington, Kentucky firefighter died while another was injured and their employer was cited by Kentucky OSHA for failing to utilize two in, two out procedures. In the second example, two inside firefighters died from smoke inhalation in Philadelphia, Pennsylvania while two outside firefighters were performing hydrant and pump operations. No outside firefighter was accountable for monitoring the inside personnel. Miles further discusses a case when there were two firefighters assigned to standby for rescue. Four interior firefighters were trapped in an

apartment building in Pittsburgh, Pennsylvania and were rescued by the standby personnel. The four interior firefighters and two rescuers were injured, but all survived.

The allowed exception is stated in the standard, “Nothing in this standard is meant to preclude firefighters from performing emergency rescue activities before an entire team has assembled” (Respiratory Protection, 1998, p. 419).

Another clarification is made concerning the type of fires that the two in, two out requirement is in effect. It is in effect during interior structural firefighting activities performed to control or extinguish a fire that is in an advanced stage of burning inside a building. An incipient fire, however, is controlled by small hose lines or portable extinguishers and the two in, two out requirement is not in effect on these types of fires (OSHA, 1998).

Kansas regulates occupational safety and health through KDHR. A letter, written by Rudolph L. Leutzinger (personal communication, January 29, 1999), representing KDHR, explains their position of some of the issues associated with 29 CFR 1910.134. Leutzinger states that KDHR will cite the respiratory protection standard during regular inspections and in the evaluation of a fatality or near miss. A minimum of two firefighters for entry and two located outside for rescue are necessary. The minimum number of personnel necessary to begin an interior attack is four, two for entry and two located outside for rescue. Leutzinger does not indicate if the incident commander, pump operator, neither, or both can be assigned to the rescue team, but states that it is left to the incident commander operating within departmental SOPs to determine duties at a fire scene.

KDHR’s position on enforcement of the OSHA two in, two out rule greatly influenced this project. Even though Kansas is not listed as an OSHA state, Fort Scott Fire Department will be held accountable to the rule through KDHR regulations, inspections, and evaluations.

National Standards

The National Fire Protection Association (NFPA) standard on occupational safety and health addresses the number of required fire personnel at emergency incidents. Personnel working in hazardous areas shall operate in teams of two or more. In the initial stages of an incident with one team operating in the hazardous area at a working structure fire, a minimum of four individuals is required. Two personnel are working as a team in the hazardous area, and two personnel are outside the hazardous area for assistance or rescue (NFPA 1500, 1997). Although NFPA recommends a minimum acceptable fire company staffing of four, the appendix of NFPA 1500 provides more information on minimum staffing at emergency incidents. Five members are recommended for engine companies responding in high-risk areas and six members with each ladder company. These recommendations are based upon actual fires and objective evaluations of fire company effectiveness. There were significant reductions in performance and safety when crews were staffed with less than the above recommendations. “Overall, five member crews were found to provide a more coordinated approach for search and rescue and fire suppression tasks” (NFPA 1500, 1997, p.39).

The outside personnel are responsible for “...maintaining a constant awareness of the number and identity of members operating in the hazardous area...” (NFPA 1500, 1997, p.19). NFPA 1500 clarifies that the initial stages of an incident encompass tasks undertaken by the first arriving company with one team in the hazardous area.

One of the outside persons is permitted to perform other duties such as incident commander, pump operator, or aide. No person may be assigned as standby personnel if, by abandoning their task to assist or rescue the inside personnel, they clearly jeopardize the health or safety of any firefighter working at the incident.

Three examples of how to meet the standard with four personnel are given in Appendix A of NFPA 1500 (1997). First, the team leader and one firefighter enter the structure while the pump operator and one firefighter are the standby personnel. The second example is the same as the first example except the pump operator also serves as the incident commander. Third, two firefighters enter the structure, and the team leader and pump operator are the standby personnel.

An exception is allowed if arriving personnel find an imminent life-threatening situation where immediate action could save a life. This action is permitted with less than four personnel when conducted in accordance with risk management principles as outlined in NFPA 1500 (NFPA 1500, 1997).

The literature review of national standards influenced this project because even though the NFPA standard states four personnel are required, the appendix recommends five-person companies for high-risk areas and six-person ladder companies. The NFPA examples of how to assign the duties of a four-person company influenced this project because in all three cases, if a rescue is necessary, there will be no person left outside to remain in command of the incident, direct in-coming crews, call for additional help, operate the pump, or perform other critical tasks.

PROCEDURES

Research Methodology

The research for this project was descriptive in that a literature review and survey were conducted to describe fire service opinions, federal and state regulations, national standards, and Kansas fire departments' policies regarding staffing requirements at the scene of interior structural firefighting operations. Additionally, it was intended to identify potential changes or

safety improvements that should be made at Fort Scott Fire Department concerning staffing at interior structural firefighting operations.

The survey was conducted to determine staffing requirements at interior structural firefighting operations of other paid or combination fire departments in Kansas. A survey was faxed to all 51 Kansas fire departments, with 36 returns, listed in the 1998 National Directory of Fire Chiefs that were identified as either paid or combination. Volunteer departments were not included because the intent was to survey departments that have fire personnel on duty 24 hours a day, similar to Fort Scott Fire Department. A copy of the survey form is included in the Appendix.

A letter was sent to KDHR requesting clarification of its position on two in, two out compliance. A response letter was received from Rudolf L. Leutingzer representing KDHR. The response letter was reviewed as part of the literature review.

Assumptions and Limitations

It was assumed that the surveyed fire departments had some knowledge about the OSHA two in, two out rule. Additionally, it was assumed that the 1998 National Directory of Fire Chiefs would be the best source to identify the paid and combination fire departments in the state. It was assumed that the directory was the most recently published and up-to-date available source. The survey was limited to Kansas fire departments because the Kansas Department of Human Resources regulates them, like Fort Scott Fire Department, for safety compliance. All municipal fire departments in the state of Kansas are under the authority of this regulating agency while other states may have their own regulating agency or are listed as an OSHA state.

Definition of Terms

Immediately dangerous to life or health (IDLH) is an atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere (Respiratory Protection, 1998).

Interior structural firefighting is the physical activity of fire suppression, rescue, or both, inside of buildings or enclosed structures which are involved in a fire situation beyond the incipient stage (Respiratory Protection, 1998).

RESULTS

1. Is there a need to determine adequate staffing requirements at the scene of a free-burning structure fire before an interior attack is initiated?

Yes, past experience shows that providing an adequate number of firefighters at the scene of a structure fire to assist or rescue the interior firefighters could have saved lives. Evidence from the literature review clearly supported there is a need to determine adequate staffing needs at structure fires because inadequate staffing can cost lives.

One hundred thirteen out of 173 firefighters, an alarming 65.3 percent, who died on the fireground in a ten year period were caught or trapped and died from the products of combustion (Norman, 1997a). It is not known how many firefighters were at those incidents or if a rescue team was designated to assist or rescue the interior firefighters. Nevertheless, the fact is that nobody rescued them.

Both NIOSH and the state OSHA investigations into the 1997 death of a Lexington, Kentucky firefighter concluded that a two in, two out rule was not followed ("Feds and State,"

1997). This firefighter, along with another whom was seriously injured, were not missed for at least eight minutes while they were trapped in the basement of the structure.

Miles (1998) reported that two Philadelphia firefighters died from smoke inhalation while fighting a structure fire. There were two other firefighters there, but they were busy performing hydrant and pump operations. Adequate staffing requirements at this scene might have saved the lives of these two firefighters.

Two other firefighters died fighting a fire at an auto parts store in 1996. Again, no one was standing by to help them (“Major Victory,” 1998).

Coleman and Granito (1988) reported that five person companies were judged to be 100 percent effective and less-staffed companies were judged to be significantly less effective.

2. What are the federal and state regulations and national standards regarding staffing requirements at the scene of a free-burning structure fire before an interior attack is initiated?

Federal OSHA regulations mandate, for those covered under its authority, to have at least two firefighters enter the structure and at least two firefighters outside to provide emergency rescue (Respiratory Protection, 1998). OSHA wrote an interpretation of the regulation and stated in part, “Most fire departments have more than four firefighters and can assemble the numbers required on the scene by waiting for others to arrive” (OSHA, 1998, p. 37). This statement clearly implies that more than four firefighters are needed on the fireground to comply with the regulation.

Of the two outside personnel, only one may be assigned to another role. The other person must monitor the status of the inside firefighters and not be assigned additional duties. If the other outside person is assigned to pump operator duties, the position of incident commander is

unfulfilled. If this person is assigned to incident commander duties, no one is available to operate the pump. If both of these positions are filled, it will require more than four persons.

A letter from Rudolph L. Leutzinger, representing Kansas Department of Human Resources, states that KDHR will cite 29 CFR 1910.134 during regular inspections (Leutzinger, personal communication, January 29, 1999). Leutzinger further states that during an evaluation of a fatality or near miss, if it is established that the two in, two out rule was a contributing factor, it will be cited. Additionally, Leutzinger states that the minimum number of personnel necessary to begin an interior attack is four, two for entry and two located outside the structure for rescue. Leutzinger also states that the standard indicates one of the two outside persons may be assigned to other duties. Leutzinger did not state that the position of incident commander or pump operator should be left unfilled. Again, it is implied that four firefighters are necessary for entry and rescue in addition to filling the positions of incident commander and pump operator.

NFPA 1500 is a national standard that addresses the number of personnel required on the scene of emergency incidents. It states that a minimum of four individuals are required at a working structure fire, two in the hazardous area and two located outside for assistance or rescue (NFPA 1500, 1997). The appendix of NFPA 1500 recommends a minimum acceptable fire company staffing of four, five members are recommended for engine companies responding in high-risk areas, and six members recommended with each ladder company. It further states that there were significant reductions in performance and safety when crews were staffed with less than the above recommendations. "Overall, five member crews were found to provide a more coordinated approach for search and rescue and fire suppression tasks" (NFPA 1500, 1997, p.39).

The appendix of this standard also gives three examples of how to meet the standard with four personnel. One, the leader and one firefighter enter the structure while the pump operator and other firefighter are designated as the standby personnel. Two, the leader and one firefighter enter the structure, the pump operator and other firefighter are designated as the standby personnel, and the pump operator also serves as the incident commander. Third, two firefighters enter the structure, and the team leader and pump operator are the standby personnel. Example one does not have a designated incident commander. Example two has the pump operator also serve as the incident commander. In the event that a rescue was necessary, both positions would have to be abandoned. The third example has both outside personnel assigned to additional duties. These examples found in the appendix seem to conflict with the main standard that states, “One standby member shall be permitted to perform other duties outside of the hazardous area, such as apparatus operator, incident commander, or technician or aide, provided constant communication is maintained between the standby member and members of the team” (NFPA, 1997, p. 19). The standard also states that the assignment of any member shall not be allowed as standby personnel if, by abandoning their critical task(s) to assist or rescue, they clearly jeopardize the health and safety of any firefighter working at the incident.

The exception of not following the standard is allowed if arriving personnel find an imminent life-threatening situation where immediate action could save a life. This exception is similar to the exception stated in the OSHA standard.

3. What do paid or combination fire departments in Kansas perceive to appropriate staffing requirements at the scene of a free-burning structure fire before an interior attack is initiated?

A survey was faxed to 51 paid or combination fire departments in the state of Kansas to

answer question number three. Out of the 51 surveys sent out, 36 were returned for a 71 percent return ratio. Of the 36 returns, 15 were from fully paid departments and 21 were from combination departments.

Out of the 36 responding departments, a majority of 19 served a population similar to Fort Scott Fire Department, fewer than 15,000.

A plurality of the responding departments, 13, were similar to Fort Scott Fire Department by operating from one fire station.

The minimum number of fire personnel per station ranged from 0 – 30. The most frequent response to this question was three, stated by eight departments.

The minimum number of total on-duty fire personnel ranged from 0-100. The most frequent response to this question was five, stated by five departments.

Thirteen (36%) of the responding departments stated that they require five or more fire personnel on the scene before initiating an interior attack on a free-burning structure fire. The same number of respondents, 13, stated they require four personnel on the scene. One department stated they require only one person on the scene, four departments require three persons, and five departments did not answer this question.

Twenty-six (72%) of the respondents stated they designate a two-person rescue or rapid intervention team before an interior attack is allowed to be initiated on a free-burning structure fire. The other 10 (28%) of the respondents stated they did not require a rescue team. Of the 26 departments that designate a rescue team, nine of them said they staff it with initial arriving personnel and nine of them wait for additional on-duty personnel to arrive.

Thirteen (36%) of the responding departments have a written policy that they believe complies with the OSHA two in, two out rule. The remaining 23 (64%) departments do not have

a written policy addressing the two in, two out rule. Of the 13 departments that have written policies in place, four (31%) require five or more personnel, seven (54%) require four personnel, one (7.5%) requires three personnel, and one (7.5%) did not answer that question. Of the 23 departments that do not have written policies in place, nine (39%) require five or more personnel on the scene before conducting an interior attack, six (26%) require four personnel, three (13%) require three personnel, one (4%) requires two personnel, and four (18%) did not answer that question.

The thirteen departments that have written policies in place sent a copy of their policy. All were reviewed and it was found they all used very similar language to the OSHA rule, but none were specific about how to staff the rescue team, regardless of the number of personnel they stated were required before initiating an interior attack.

The following table shows the complete results of the survey.

1. Please answer the following questions about your fire department.	Number of Responses
A. Department Type	
Fully Paid	15
Combination	21
B. Population Served	
Under 15,000	20
15,000-49,999	11
50,000-99,999	3
100,000 and over	2

C. Number of fire stations	
1	13
2	11
3	4
4	2
5	1
8	2
12	1
16	1
18	1
D. Minimum number of fire personnel per station	
0	2
1	6
2	7
3	8
4	6
5	4
6	1
7	1
30	1
E. Minimum number of total fire personnel on duty	
0	3
1	4

2	4
3	2
4	4
5	5
7	2
8	1
11	3
12	1
14	2
19	1
31	1
40	1
60	1
100	1
F. Minimum number of fire personnel required on scene before an interior attack on a free-burning structure fire is allowed to be initiated?	Number of responses
Did not answer this question	5
2	1
3	4
4	13
5	7
6	5
7	1

2. Does your department designate a two-person rescue or rapid intervention team before an interior attack on a free-burning structure fire is allowed to be initiated?	Number of responses
Yes	26
No	10

3. If you answered yes to question number 2, how do you staff this team?	Number of responses
With initial arriving personnel	9
Wait for additional on-duty personnel to arrive	9
Wait for additional off-duty personnel to arrive	4
Wait for mutual aid personnel to arrive	2
Please explain if necessary	
Use the pump operator and incident commander	1
Still exploring possibilities	1

4. Does your department have a written policy that complies with the OSHA two in/ two out rule?	Number of responses
Yes	13
No	23

4. What factors are appropriate for consideration in the development of Fort Scott Fire Department's policy regarding staffing requirements at the scene of a free-burning structure fire before an interior attack is initiated?

Preventing firefighter fatalities and injuries on the fireground is the first and most important factor in developing a staffing policy at structure fires. Norman (1997a) points out that 65 percent of fireground firefighter fatalities in a 10-year period were caused from exposure to products of combustion. Norman also emphasizes that a two-person rescue team will have difficulty removing an unconscious firefighter from anywhere except the first floor and recommends that the rescue team have more than two persons (Norman, 1997b). Norman (1997b, p.75) further clarifies the number of firefighters need to rescue another firefighter by stating, "You must arrange for a team (I believe four people is the absolute minimum to carry out a successful rescue of a downed firefighter, in simple circumstances) to be immediately available at every working fire or special operation." Cobb (1998) states that once incident commanders are aware of missing members, there are no resources available to rescue them. Fireground safety and following the intent of the two in, two out rule is summarized by Chief Holleran of Lexington, Kentucky who lost a firefighter in a structure fire in 1997. Holleran says that we want to try to avoid tragic incidents like this at all costs ("Feds and State," 1997).

The second factor to be considered is the laws and regulations of the state of Kansas regarding staffing requirements at structure fires. OSHA federal regulations require at least two persons to enter an IDLH atmosphere, and at least two persons located outside for assistance or rescue (Respiratory Protection, 1998). KDHR will cite those regulations during inspections or in the evaluation of firefighter fatalities or near misses (Leutzinger, personal communication, January 29, 1999). Counting the two entry firefighters and two outside firefighters, Leutzinger

also states that the minimum number of personnel to begin an interior attack on a free-burning structure fire is four, with no mention of staffing the incident commander and pump operator positions. Miles' (1998) interpretation of the OSHA standard clearly implies that more than four firefighters are necessary for compliance by stating, "Most fire departments have more than four firefighters and can assemble the numbers required on the scene by waiting for others to arrive" (p. 37).

The third factor to be considered is current national standards. Although NFPA 1500 (1997) recommends a minimum acceptable fire company staffing of four, the appendix of the same standard states that five members are recommended for engine companies responding in high-risk areas and six members with each ladder company. Since Fort Scott Fire Department operates only one station with a single company response to all areas including high-risk, it is reasonable to assume that it should be staffed with at least five members for the initial attack on a structure fire.

The fourth factor to be considered is how other fire departments in the state of Kansas address staffing requirements at a structure fire. More than one-third of the fire departments that responded to the survey stated that they require five or more persons on scene before allowing an interior attack on a free-burning structure fire. The same number of departments reported that they require four persons on scene before initiating an interior attack. The remaining departments require three or less persons or did not answer the question on the survey. Dzubian's survey of 118 fire departments with 84 returns showed 47.6 percent of the responding fire departments required five or more persons on scene before initializing an interior attack and only 38.1 percent required four (Dzubian, 1998). The remaining departments required less than four or did not answer the question.

The last factor considered in the development of a staffing policy at structure fires is economics. Marantette (1998) pointed out that the debate over the cost of fire protection, firefighter safety, and potential property loss will continue regardless of the OSHA two in, two out rule. Coleman and Granito (1988) stated that fire spread, dollar loss, and injuries, were significantly increased if about sixteen trained firefighters were not on the scene of a working structure fire within the critical time period. They further stated that a fire company with five persons was judged to be 100 percent effective, while a four-person company was only 65 percent effective and a three-person company was only 38 percent effective. Their statements were based on controlled and statistically based experiment conclusions. It is reasonable to expect that firefighter fatalities and injuries, civilian lives lost, and property loss will increase in relation to a decrease in fire company effectiveness.

DISCUSSION

The study results indicate that the two in, two out rule requires more than four firefighters to fulfill the intent of the rule. An unexpected finding from the survey was that 39 percent of responding departments that did not have a written policy concerning staffing requirements still required five or more persons on the scene before initiating an interior attack. Only 26 percent of the same group of departments required only four persons on the scene before initiating an interior attack.

After researching and studying firefighter safety, federal and state laws, national safety standards, and actual procedures from Kansas fire departments, there is sufficient evidence to support the premise that more than four firefighters are necessary to safely conduct an interior attack on a free-burning structure fire.

Firefighters have died in structure fires because there were no available personnel to rescue them. Two firefighters in Lexington, Kentucky were not missed for at least eight minutes while they were trapped in the basement of the structure. One of them was seriously injured and the other died of his injuries ("Feds and State," 1997). Miles (1998) documented a case in Philadelphia, Pennsylvania where two firefighters died in a structure fire even though two others were on the scene. The two outside firefighters were engaged in hydrant and pump operations. Miles also documented a case in Pittsburgh, Pennsylvania where lives were saved because there was an adequate number of personnel available to rescue them. The fire department implemented a rescue team system after a fatal fire. Later, four firefighters were trapped in an apartment building structure fire and were rescued by standby personnel. There were several injuries, but all survived the incident. Without the standby team in place, the outcome could have been another tragedy in firefighter safety.

Norman (1997b) believes that a minimum four people are necessary just to carry out the rescue of one downed firefighter. By using his idea, a minimum of eight firefighters are needed at the scene, two for entry, four for standby rescue, one incident commander, and one pump operator.

The OSHA two in, two out rule must be followed in the state of Kansas. Leutzinger (personal communication, January 29, 1999) stated that KDHR would cite 29 CFR 1910.134 during regular inspections and during the evaluation of fatalities or near misses. This is consistent with Seymour's (1998) statement in reference to the scope of coverage of the OSHA respiratory standard,

Those that believe they are not affected by this standard need to realize that this new standard is going to be the criterion against which everyone will be measured if there is

ever any question about providing due care for response personnel regarding inhalation hazards.

OSHA does not specifically state the number of personnel required on the scene and NFPA 1500 states a minimum of four personnel are required on the scene before conducting an interior attack on a structure fire (NFPA 1500). In the appendix of NFPA 1500 it is recommended that engine companies in high-risk areas be staffed with five persons and ladder companies should be staffed with six persons. This leaves a big question for small, one-station fire departments like Fort Scott concerning how many personnel should be on the scene before initiating an interior attack. The survey results showed that half of the departments that designate a rescue team require four persons on the scene and half require five or more persons on the scene. In those first several minutes of the incident the fire is likely to escalate making interior conditions worse. Waiting several minutes for additional personnel could actually increase the risks to the entry team. Fire spread and property loss may also increase by waiting for a period of time. Cobb (1998) pointed out that recent reports indicate firefighters are being killed in the initial stages of the fire. That is why it is so important to provide an adequate number of personnel available in those first several minutes of the fire, when the risk of being seriously injured or killed is possibly the highest.

In the survey, 36 percent of the fire departments required five or more personnel and 36 percent required four personnel to make an interior attack on a structure fire. This is comparable to Dzubian's (1998) findings that 47.6 percent of his surveyed fire departments required five or more personnel and 38.1 percent required four personnel to initiate an interior attack on a structure fire.

The author's interpretation of the study results is that if there is not five or more persons on the scene of a structure fire and the interior firefighters need rescued, there is a high probability that additional safety problems will immediately arise. If the incident commander has to abandon his/her command responsibilities to assist or rescue the interior team, no one is left in charge at a critical time when a commander is needed the most to prevent the situation turning from critical to chaotic. If the pump operator abandons the duties of pump operations to go inside to assist or rescue the interior team and water supply is lost, the situation could rapidly escalate from extremely dangerous to another unnecessary tragic loss of life.

The organizational implication of this study is that Fort Scott Fire Department, along with the city manager and city commission, will determine the level of safety compliance desired and take appropriate steps to achieve it. If the fire department continues to conduct the initial interior attack with only four on-duty personnel, either the incident commander position or the pump operator position will need be vacated to monitor the inside team to meet the requirements of the two in, two out rule. If the department waits for additional off-duty personnel or reserves to respond before initiating an interior attack, at least eight to ten minutes of additional burn time will be allowed. This is assuming off-duty personnel can respond to the station in four minutes, don their gear, and respond to the fire in another four minutes with additional fire apparatus. If the department implements a five-person initial response, two persons can enter the structure, one person can monitor their status, the incident commander can serve as the second rescue team member, and the pump operator can maintain adequate water supply to the interior members.

RECOMMENDATIONS

The first recommendation is that Fort Scott Fire Department should develop, implement, and follow a standard operating procedure concerning staffing requirements at structure fires that is in compliance with the OSHA two in, two out rule.

The second recommendation is to maintain a staffing level of at least five persons to respond to structure fires. The study showed that there is a need to provide an adequate number of personnel, to operate safely while conducting an interior attack, at the scene of a free-burning structure fire. Fort Scott Fire Department operates with only one station and one company response, and must wait several minutes for off-duty personnel and reserves to be called back for assistance at structure fires. Therefore, it should maintain a staffing level of at least five persons to initially respond to structure fires. This will eliminate waiting for off-duty personnel to respond before beginning interior fire attack operations. This will also put the fire department in compliance with the OSHA two in, two out rule and NFPA 1500.

The third recommendation is to explore options to provide the most cost-effective method of maintaining a five-person staffing level. Options include scheduling changes, organizational structure changes, and extensive use of part-time reserve firefighters.

REFERENCE LIST

- Bruno, H. (1998, February). Fire Politics: OSHA Mandates “2-In/2-Out” Operations. *Firehouse*, (1998, February), 10.
- Campbell, C. A. (1998, February). Washington Report: OSHA mandates two-in, two-out on the fireground. *Fire Chief*, 42, (2), 12.
- Cobb, Robert W. (1998, May). Rapid Intervention Teams: A Fireground Safety Factor. *Firehouse*, (1998, May), 52-54.
- Coleman, R. J., & Granito, J. A. (Eds.). (1988). *Managing Fire Services* (2nd ed.). Washington, D. C.: International City Management Association.
- Dziuban, J. (1998). *Two-in/Two-out Standard Operating Procedures for the Saginaw Fire Department*. (Strategic Management of Change Research Paper). Emmitsburg, MD: National Fire Academy.
- Feds and State Fault Lexington Department in Fire Fighter Death (1997). *International Fire Fighter*, 80, (2), 6.
- Major Victory for Fire Fighter Safety: IAFF-Backed 2 In/2 Out Rule is Clear OSHA Standard (1998). *International Fire Fighter*, 81, (1), 1+.
- Marantette, M. (1998, May). Two-in/two-out is an opportunity, not a burden. *Fire Chief*, 42, (5), 36-37.
- Miles, John B. (1998). *Two-in/two-out procedure in firefighting/IDLH environments* [On-line]. Available Internet: http://www.osha-slc.gov/OshDoc/Interp_data/I19980429.html
- National Fire Protection Association (1997). *NFPA 1500: Standard on Fire Department Occupational Safety and Health Program*. (1997 ed.). Quincy, MA: Author.

Norman, J. (1997a). Fireground Tactics: Firefighter Survival. *Firehouse*, (1997, July), 18-22.

Norman, J. (1997b). Fireground Tactics: Firefighter Survival-Part 2. *Firehouse*, (1997, September), 75+.

Occupational Safety and Health Administration. (1998). *Questions and Answers on the Respiratory Protection Standard* [On-line]. Available Internet:
<http://www.osha-slc.gov/RespiratorOutreach/faq.html>

Respiratory Protection; Final Rule, 63 Federal Register (1998).

Respiratory Protection Standard, 29 C.F.R. § 1910.134 (1998).

Routley, J. G., Bush, R., & Stern, J. (July, 1996). Firefighter Fatalities: What The Fire Service Can Do To Prevent Line-Of-Duty Deaths. *Firehouse*, (1996, July), 50+.

Seymour, T. H. (1998). *A Comprehensive Analysis of the OSHA Respiratory Protection Standard 29 CFR 1910.134*. Fairfax, VA: International Association of Fire Chiefs.

Soros, C. (1997). FDSOA's Position on "Two In and Two Out". *Health & Safety*, 8, (2), 1+.

Varone, J. C. (1994). *Providence Fire Department Staffing Study*. (Executive Development Research Paper). Emmitsburg, MD: National Fire Academy.

APPENDIX

TWO IN/ TWO OUT STAFFING SURVEY

1. Please answer the following questions about your fire department:
 - A. Department Type
 - ☐ Fully Paid
 - ☐ Combination
 - B. Population Served
 - ☐ Under 15,000
 - ☐ 15,000-49,999
 - ☐ 50,000-99,999
 - ☐ 100,000 and over
 - C. Number of fire stations: _____
 - D. Minimum number of fire personnel per station : _____
 - E. Minimum number of total fire personnel on duty: _____
 - F. Minimum number of fire personnel required on scene before an interior attack on a free-burning structure fire is allowed to be initiated: _____

2. Does your department designate a two-person rescue or rapid intervention team before an interior attack on a free-burning structure fire is allowed to be initiated?
 - ☐ Yes
 - ☐ No

3. If you answered yes to question number 2, how do you staff this team?
 - ☐ With initial arriving personnel
 - ☐ Wait for additional on-duty personnel to arrive
 - ☐ Wait for additional off-duty personnel to arrive
 - ☐ Wait for mutual aid personnel to arrive
 - ☐ Please explain if necessary

4. Does your department have a written policy that complies with the OSHA two in/ two out rule?
 - ☐ Yes
 - ☐ No

If yes, please include it with this survey.

PLEASE RETURN THIS SURVEY BY JANUARY 11, 1999

BY FAX TO: **316.223.8110**

Or by mail to:

Jeff Davis

Fort Scott Fire Department

1604 S National Ave.

Fort Scott, KS 66701

- ☐ Please check here and write the name of your city if you would like to have a copy of the results of this survey: _____